WHAT IS CLAIMED IS:

1. (amended) A method of cleaning wafer surfaces, comprising the steps of:

providing a wafer surface bearing overlying material thereon; and

cleaning the wafer surface by removing at least a portion of the overlying material from the wafer surface by applying an aqueous solution comprising one or more inorganic fluorine-comprising compounds and one or more organic acids in a ratio of about 100:1 to about 55:45 (v/v), the solution having a pH of about 3 to about 9, such that the surface of the wafer is rendered substantially hydrophobic.

12. (amended) A method for surface treating wafer surfaces, comprising the steps of:

providing a wafer surface having a low-k dielectric layer disposed thereon and a photoresist layer overlying the dielectric layer; and

treating the wafer surface to remove at least a portion of the dielectric layer with minimal removal of the photoresist layer, by applying an aqueous solution of one or more inorganic fluorine-comprising compounds and one or more organic acids, the solution having a pH of about 2 to about 6, such that the dielectric layer is selectively removed at a rate of greater than about 1000 angstroms per minute.

13. The method of Claim 12, wherein the aqueous solution comprises at least hydrofluoric acid and the one or more organic acids in a ratio of about 2:1 (v/v), such that the dielectric layer is selectively removed at a rate of about 2300 to about 2700 angstroms per minute.

14. The method of Claim 12, wherein the aqueous solution comprises at least ammonium fluoride and the one or more organic acids in a ratio of about 2:1 (v/v).

20. A method of cleaning wafer surfaces, the method comprising the steps of:

providing an aqueous solution comprising at least one inorganic fluorine-comprising compound selected from the group consisting of hydrofluoric acid and ammonium fluoride, and

mixtures thereof; and at least one organic acid selected from the group consisting of citric acid, acetic acid, ascorbic acid, and mixtures thereof;

providing a wafer having a low-k dielectric material disposed on at least a portion of one surface; and

contacting the surface of the wafer having the low-k dielectric material thereon with the aqueous solution under conditions effective to remove at least a portion of the low-k dielectric material at a rate of about 50 to about 1000 angstroms per minute.

21. The method of Claim 20, wherein the aqueous solution comprises about 30 % to about 70 % by volume of the fluorine-comprising compound, and about 30 % to about 70 % by volume of the organic acid, based on the total volume of the solution.

26. A method of cleaning wafer surfaces, the method comprising the steps of:

providing an aqueous solution comprising an inorganic fluorine-comprising compound selected from the group consisting of hydrofluoric acid and ammonium fluoride, and mixtures thereof; and an organic acid selected from the group consisting of citric acid, acetic acid, ascorbic acid, and mixtures thereof;

providing a wafer having a low-k dielectric material disposed on at least a portion of one surface; and

contacting the surface of the wafer having the low-k dielectric material thereon with the aqueous solution under conditions effective to remove at least a portion of the low-k dielectric material at a rate greater than about 1000 angstroms per minute.

27. The method of Claim 26, wherein the aqueous solution includes at least hydrofluoric acid and one or more organic acids in a ratio of about 2:1 (v/v).

28. The method of Claim 27, wherein the aqueous solution includes about 63 to about 70 % by volume of hydrofluoric acid, and about 30 to about 36 % by volume of the one or more organic acids.

29. The method of Claim 26, wherein the aqueous solution includes at least ammonium fluoride and one or more organic acids in a ratio of about 2:1 (v/v).

30. The method of Claim 26, wherein the aqueous solution includes about 63 to about 70 % by volume of ammonium fluoride, and about 30 to about 36 % by volume of the one or more organic acids.

31. (amended) A method of surface treating wafer surfaces, comprising the steps of:

providing a wafer surface having a low-k dielectric layer disposed thereon and a photoresist layer overlying the dielectric layer; and

providing an aqueous composition comprising at least one inorganic fluorine-comprising compound, and a major amount of one or more organic acids; and

contacting the surface of the wafer having the low-k dielectric and photoresist layers thereon with the composition under conditions effective to selectively remove the photoresist layer while leaving the low-k layer substantially intact on the substrate.

32. (amended) The method of Claim 31, wherein the composition comprises an aqueous solution of at least hydrofluoric acid and the one or more organic acids in a ratio of about 1:100 to about 45:55 (v/v), such that the composition removes the photoresist mask substantially completely from the surface.

33. The method of Claim 31, wherein the inorganic fluorine-comprising compound is selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof; and the organic acid is selected from the group consisting of citric acid, gallic acid, acetic acid, formic acid, propionic acid, n-butyric acid, isobutyric acid, benzoic acid, ascorbic acid, gluconic acid, malic acid, malonic acid, oxalic acid, succinic acid, tartaric acid, and mixtures thereof.

34. The method of Claim 31, wherein the organic acid is selected from the group consisting of citric acid, acetic acid, ascorbic acid, and mixtures thereof.

35. The method of Claim 31, wherein the step of contacting the surface of the wafer comprises immersing the wafer in a bath of the composition, spraying the surface of the wafer with the composition, exposing the wafer to a vapor, or any combination thereof.

---

76. (new) The method of Claim 1, wherein the inorganic fluorine-comprising compound is selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof.

77. (new) The method of Claim 1, wherein the organic acid is selected from the group consisting of citric acid, gallic acid, acetic acid, formic acid, propionic acid, n-butyric acid, isobutyric acid, benzoic acid, ascorbic acid, gluconic acid, malic acid, malonic acid, oxalic acid, succinic acid, tartaric acid, and mixtures thereof.

78. (new) The method of Claim 1, wherein the organic acid is selected from the group consisting of citric acid, acetic acid, ascorbic acid, and mixtures thereof.

79. (new) A method of cleaning a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to remove organic material and low-k dielectric material from the surface of the substrate, the aqueous solution effective to selectively remove the dielectric layer at a rate greater than about 2000 angstroms per minute; the aqueous solution comprising one or more organic fluorine-comprising compounds and one or more inorganic acids, and having a pH of about 2 to about 6.

80. (new) A method of cleaning a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to remove dielectric material and organic material and render the surface hydrophobic; the aqueous solution comprising an

inorganic fluorine compound and an organic acid in a ratio of about 1:2 to about 2:1 (v/v), and having a pH of about 3 to about 6.

81. (new) The method of Claim 80, wherein the aqueous solution removes the dielectric material at a rate of about 50 to about 1000 angstroms per minute.

82. (new) The method of Claim 80, wherein the aqueous solution removes the dielectric material at a rate of about 50 to about 600 angstroms per minute.

83. (new) The method of Claim 80, wherein the aqueous solution comprises hydrofluoric acid and an organic acid in a ratio of about 1:2 (v/v), and has a pH of about 3 to about 4; and the aqueous solution removes the dielectric material at a rate of about 400 to about 600 angstroms per minute.

84. (new) The method of Claim 80, wherein the aqueous solution comprises ammonium fluoride and an organic acid in a ratio of about 2:1 (v/v), and has a pH of about 4 to about 6; and the aqueous solution removes the dielectric material at a rate of about 50 to about 150 angstroms per minute.

85. (new) The method of Claim 80, wherein the step of contacting the surface of the wafer comprises immersing the wafer in a bath of the composition, spraying the surface of the wafer with the composition, exposing the wafer to a vapor, or any combination thereof.

86. (new) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material to render the surface hydrophobic, the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 1:2 to about 2:1 (v/v), and having a pH of about 3 to about 6; the inorganic fluorine compound selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof.

87. (new) The method of Claim 86, wherein the organic acid is selected from the group consisting of citric acid, gallic acid, acetic acid, formic acid, propionic acid, n-butyric acid, isobutyric acid, benzoic acid, ascorbic acid, gluconic acid, malic acid, malonic acid, oxalic acid, succinic acid, tartaric acid, and mixtures thereof.

88. (new) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom and render the surface of the substrate hydrophobic; the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 1:2 to about 2:1 (v/v), and having a pH of about 3 to about 6; the inorganic fluorine compound selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof; the organic acid selected from the group consisting of citric acid, acetic acid, ascorbic acid, and mixtures thereof.

89. (new) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom at a rate of about 400 to about 600 angstroms/minute to render the surface hydrophobic; the aqueous solution comprising hydrofluoric acid and an organic acid in a ratio of about 1:2 (v/v), and having a pH of about 3 to about 4.

90. (new) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom at a rate of about 50 to about 150 angstroms/minute to render the surface hydrophobic; the aqueous solution comprising ammonium fluoride and an organic acid in a ratio of about 2:1 (v/v), and having a pH of about 4 to about 6.

91. (new) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom at a rate of about 50 to about 150 angstroms/minute to render the surface hydrophobic; the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 30:70 to about 70:30 % by volume, and having a pH of about 3 to about 6.

92. (new) The method of Claim 91, wherein the aqueous solution removes the dielectric material at a rate of about 50 to about 1000 angstroms per minute.

93. (new) The method of Claim 91, wherein the aqueous solution removes the dielectric material at a rate of about 50 to about 600 angstroms per minute.

Ayout

94. (new) The method of Claim 91, wherein the aqueous solution comprises hydrofluoric acid and an organic acid in a ratio of about 30:70 to about 40:60 % by volume, and has a pH of about 3 to about 4, and the aqueous solution removes the dielectric material at a rate of about 400 to about 600 angstroms per minute.

95. (new) The method of Claim 91, wherein the aqueous solution comprises ammonium fluoride and an organic acid in a ratio of about 60:40 to about 70:30 % by volume, and has a pH of about 4 to about 6, and the aqueous solution removes the dielectric material at a rate of about 50 to about 150 angstroms per minute.

96. (new) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to remove dielectric material from the surface of the substrate at a rate of about 400 to about 600 angstroms/minute; the aqueous solution comprising hydrofluoric acid and an organic acid in a ratio of about 30:70 to about 40:60 % by volume, and having a pH of about 3 to about 4.

97. (new) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to remove dielectric material therefrom at a rate of about 50 to about 150 angstroms per minute; the aqueous solution comprising ammonium fluoride and an organic acid in a ratio of about 60:40 to about 70:30 % by volume, and having a pH of about 4 to about 6.

98. (new) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom and render the surface hydrophobic; the aqueous solution comprising an organic fluorine compound and an inorganic acid in a ratio of about 1:5 (v/v).

99. (new) The method of Claim 98, wherein the organic fluorine-comprising compound is selected from the group consisting of hydrogen fluoride pyridinium, tetramethylammonium fluoride, triethylamine trihydrofluoride, and mixtures thereof.

Ay cont

100. (new) The method of Claim 98, wherein the aqueous solution removes the dielectric material at a rate of about 50 to about 1000 angstroms per minute.

101. (new) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom and render the surface substantially hydrophobic; the aqueous solution comprising an organic fluorine compound and an inorganic acid in a ratio of about 1:5 (v/v); the organic fluorine-comprising compound selected from the group consisting of hydrogen. fluoride pyridinium, tetramethylammonium fluoride, triethylamine trihydrofluoride, and mixtures thereof.

102. (new) The method of Claim 101, wherein the aqueous solution removes the dielectric material at a rate of about 700 angstroms per minute.

103. (new) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom to render the surface substantially hydrophobic; the aqueous solution comprising an organic fluorine compound and an inorganic acid in a ratio of about 1:5 (v/v); the organic fluorine-comprising compound selected from the group consisting of hydrogen fluoride pyridinium, tetramethylammonium fluoride, triethylamine trihydrofluoride, and mixtures thereof; and the inorganic acid selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, phosphoric acid, and mixtures thereof.

104. (new) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom to render the surface substantially hydrophobic; the aqueous solution comprising hydrogen fluoride pyridinium and an inorganic acid in a ratio of about 1:5 (v/v).

105. (new) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom to render the surface substantially hydrophobic; the aqueous solution comprising an organic fluorine compound and an inorganic acid in a ratio of about 13:86 to about 19:80 % by volume.

106. (new) The method of Claim 105, wherein the organic fluorine-comprising compound is selected from the group consisting of hydrogen fluoride pyridinium, tetramethylammonium fluoride, triethylamine trihydrofluoride, and mixtures thereof.

107. (new) The method of Claim 105, wherein the aqueous solution removes the dielectric material at a rate of about 50 to about 1000 angstroms per minute.

108. (new) The method of Claim 105, wherein the aqueous solution removes the dielectric material at a rate of about 700 angstroms per minute.

109. (new) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to remove organic material and dielectric material therefrom at a rate of about 50 to about 1000 angstroms per minute to render the surface substantially hydrophobic; the aqueous solution comprising hydrogen fluoride pyridinium and an inorganic acid in a ratio of about 13:86 to about 19:80 % by volume.

110. (new) The method of Claim 109, wherein aqueous solution removes the dielectric material at a rate of about 700 angstroms per minute.

111. (new) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove dielectric material and up to a minimal amount of organic material therefrom; the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 2:1 (v/v), and having a pH of about 2 to about 6.

112. (new) The method of Claim 111, wherein the aqueous solution removes the dielectric material at a rate of greater than about 1000 angstroms per minute.

113. (new) The method of Claim 111, wherein the aqueous solution removes the dielectric material at a rate of greater than about 2000 angstroms per minute.

114. (new) The method of Claim 111, wherein aqueous solution removes the organic material at a rate of about 1 angstrom per minute.

115. (new) The method of Claim 111, wherein the aqueous solution provides an etch selectivity ratio for the dielectric material to organic material of about 50:1 to about 1000:1.

116. (new) The method of Claim 111, wherein the inorganic fluorine-comprising compound is selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof.

117. (new) The method of Claim 111, wherein the organic acid is selected from the group consisting of citric acid, gallic acid, acetic acid, formic acid, propionic acid, n-butyric acid, isobutyric acid, benzoic acid, ascorbic acid, gluconic acid, malic acid, malonic acid, oxalic acid, succinic acid, tartaric acid, and mixtures thereof.

Ay cont

118. (new) The method of Claim 111, wherein the organic acid is selected from the group consisting of citric acid, acetic acid, ascorbic acid, and mixtures thereof.

119. (new) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove dielectric material therefrom at a rate of greater than about 1000 angstroms per minute; the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 2:1 (v/v), and having a pH of about 2 to about 6; the inorganic fluorine compound selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof.

120. (new) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove dielectric material therefrom at an etch selectivity ratio for the dielectric material to

organic material of about 50:1 to about 1000:1; the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 2:1 (v/v), and having a pH of about 2 to about 6; the inorganic fluorine compound selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof.

121. (new) The method of Claim 120, wherein the aqueous solution selectively removes the dielectric material at a rate of greater than about 1000 angstroms per minute.

122. (new) The method of Claim 120, wherein the aqueous solution selectively removes the dielectric material at a rate of greater than about 2000 angstroms per minute.

123. (new) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove low-k dielectric material and up to a minimal amount of organic material therefrom; the aqueous solution comprising hydrofluoric acid and an organic acid in a ratio of about 2:1 (v/v), and having a pH of about 2 to about 5.

124. (new) The method of Claim 123, wherein the aqueous solution selectively removes the low-k dielectric material at an etch selectivity ratio for the dielectric material to organic material of about 50:1 to about 1000:1.

125. (new) The method of Claim 123, wherein the aqueous solution selectively removes the dielectric material at a rate of greater than about 1000 angstroms per minute.

126. (new) The method of Claim 123, wherein the aqueous solution selectively removes the dielectric material at a rate of greater than about 2000 angstroms per minute.

127. (new) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove low-k dielectric material and up to a minimal amount of organic material therefrom; the aqueous solution comprising ammonium fluoride and an organic acid in a ratio of about 2:1 (v/v), and having a pH of about 3 to about 6.

128. (new) The method of Claim 127, wherein the aqueous solution selectively removes the low-k dielectric material at an etch selectivity ratio for the dielectric material to organic material of about 50:1 to about 1000:1.

129. (new) The method of Claim 127, wherein the aqueous solution selectively removes the dielectric material at a rate of greater than about 1000 angstroms per minute.

130. (new) The method of Claim 127, wherein the aqueous solution selectively removes the dielectric material at a rate of greater than about 2000 angstroms per minute.

131. (new) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove low-k dielectric material and up to a minimal amount of organic material therefrom; the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 63:36 to about 70:30 % by volume, and having a pH of about 2 to about 6.

132. (new) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove low-k dielectric material therefrom at a rate of greater than about 1000 angstroms per minute; the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 63:36 to about 70:30 % by volume, and having a pH of about 2 to about 6; the inorganic fluorine compound selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof.

133. (new) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove low-k dielectric material therefrom at an etch selectivity ratio for the dielectric material to organic material of about 50:1 to about 1000:1; the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 63:36 to about 70:30 % by volume; the composition having a pH of about 2 to about 6; the inorganic fluorine compound selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof.

134. (new) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively organic material and up to a minimal amount of low-k dielectric material therefrom; the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 1:100 (v/v), and having a pH of about 3 to about 4.

Pg Cont

135. (new) The method of Claim 134, wherein the aqueous solution removes organic material at a rate of about 400 to about 600 angstroms per minute.

136. (new) The method of Claim 134, wherein the aqueous solution selectively removes the organic material at an etch selectivity ratio for the organic material to dielectric material of about 200:1.

137. (new) The method of Claim 134, wherein the aqueous solution removes the organic material at a rate of about 200 angstroms per minute and the dielectric material at a rate of about 1 angstrom per minute.

138. (new) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove organic material therefrom at an etch selectivity ratio of about 200:1; the aqueous

solution comprising hydrofluoric acid and an organic acid in a ratio of about 1:100 (v/v), and having a pH of about 3 to about 4.

139. (new) The method of Claim 138, wherein the organic material comprises a photoresist material.

Amend

140. (new) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove organic material therefrom at an etch selectivity ratio of the organic material to low-k dielectric material of about 200:1; the aqueous solution comprising up to about 2% by volume hydrofluoric acid and about 98-99% by volume aqueous organic acid, and having a pH of about 3 to about 4.

141. (new) The method of Claim 140, wherein the organic acid is an about 20-60% aqueous solution.